Progress Energy

January 16, 2012

SERIAL: BSEP 12-0008 10 CFR 50.73

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Brunswick Steam Electric Plant, Unit No. 2
Renewed Facility Operating License No. DPR-62
Docket No. 50-324
Licensee Event Report 2-2011-002

Ladies and Gentlemen:

In accordance with the Code of Federal Regulations, Title 10, Part 50.73, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc., submits the enclosed Licensee Event Report (LER). This report fulfills the requirement for a written report within sixty (60) days of a reportable occurrence.

Please refer any questions regarding this submittal to Ms. Annette Pope, Supervisor - Licensing/Regulatory Programs, at (910) 457-2184.

Sincerely,

Edward L. Wills, Jr.
Director - Site Operations
Brunswick Steam Electric Plant

MAT/mat

Enclosure:

Licensee Event Report

IE22
NRR

Progress Energy Carolinas, Inc.
Brunswick Nuclear Plant
P.O. Box 10429
Southport, NC 28461

cc (with enclosure):

U. S. Nuclear Regulatory Commission, Region II
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U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
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NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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4. TITLE
Unanalyzed Condition Due to Reactor Pressure Vessel (RPV) Head Detensioned During Startup

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
11	16	2011	2011	002	00	01	16	2012	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE: 2

10. POWER LEVEL: 007

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☒ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Mark Turkal, Lead Engineer - Licensing	(910) 457-3066

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On November 16, 2011, Unit 2 was in power ascension following a mid-cycle maintenance outage which required reactor vessel disassembly. At 0309 Eastern Standard Time (EST), with Unit 2 operating in Mode 2 at a maximum of 7 percent of rated thermal power, a manual reactor scram was inserted due to elevated drywell leakage. This condition is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in manual actuation of the Reactor Protection System (RPS). On November 17, 2011, at 1345 EST, it was determined that an unanalyzed condition existed on Unit 2. With Unit 2 operating in Mode 4, leak investigation activities determined that the reactor pressure vessel (RPV) head was not fully tensioned. This condition is being reported in accordance with 10 CFR 50.73(a)(2)(ii)(B), as a condition that resulted in the plant being in an unanalyzed condition that significantly degraded plant safety.

The root cause of this event is the failure to provide the proper training and procedure guidance to correctly interpret critical data used to validate that the RPV head nuts were properly tightened. Corrective actions include implementing refueling procedure and training program changes to ensure that adequate training and guidance is provided to refueling floor personnel.

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NARRATIVE

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

Introduction

Initial Conditions

At the time of the event, Unit 2 was in Mode 2, operating at approximately 7 percent of rated thermal power (RTP).

Reportability Criteria

This event resulted in a valid manual actuation of the Reactor Protection System (RPS) [JC] and, as such, this event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B). The NRC was initially notified of this event on November 16, 2011 (i.e., Event Number 47444).

This event is also being reported in accordance with 10 CFR 50.73(a)(2)(ii)(B), as an event or condition that resulted in the plant being in an unanalyzed condition that significantly degraded plant safety. The NRC was initially notified of this condition on November 17, 2011 (i.e., Event Number 47452).

Event Description

On November 16, 2011, Unit 2 was in power ascension following a mid-cycle maintenance outage, which required reactor vessel disassembly. With Unit 2 operating in Mode 2, BSEP Operators noted increasing drywell floor drain [BD] leakage and, at 0301 Eastern Standard Time (EST), an Unusual Event was declared as a result of unidentified drywell leakage exceeding 10 gallons per minute (gpm). At 0309 EST, a manual reactor scram was inserted from approximately 7 percent of rated thermal power due to the continued increase in unidentified drywell leakage.

Following the scram, the reactor was depressurized and the unidentified leak rate decreased to less than 10 gpm within one hour. At 1345 EST on November 17, 2011, with Unit 2 operating in Mode 4, leak investigation activities determined that the reactor pressure vessel (RPV) head was not fully tensioned and, as a result, an unanalyzed condition existed on Unit 2. Subsequently, it was determined that none of the 64 RPV head stud/nut assemblies were adequately tensioned.

Investigation of this event determined that it was a result of errors made while tensioning the reactor vessel head studs and during the validation process to ensure the head was properly tensioned.

Tensioning

Tensioning the reactor vessel head is a repetitive process using four hydraulic tensioners and a common hydraulic pumper to simultaneously tension four of the reactor vessel head studs. Tensioning is accomplished by attaching the tensioner to the stud's uppermost threads. The stud nut is rotated on the stud

Event Description (continued)

to establish contact with its washer on the top of the reactor head flange. Hydraulic pressure is applied to the tensioner and stretches the stud. The mechanic at the tensioner then rotates the stud nut to make firm contact with the washer on the head flange. When the hydraulic pressure is released, the nut maintains the stretch in the stud, applying closing pressure to the flanges of the reactor vessel and head. Once the four studs are tensioned, the tensioners are relocated to the next set of four studs.

Following the event, the tensioning process was assessed through equipment troubleshooting, review of procedure 0SMP-RPV502, "Reactor Vessel Reassembly," and interviews with refuel floor personnel. The equipment was found to be fully functional and capable of providing the proper tension to the RPV head stud/nuts. However, it was determined that individuals operating the tensioning equipment misinterpreted the digital display of the hydraulic pressure being applied to elongate the vessel studs and incorrectly believed that the actual pressure being applied was a factor of 10 greater than the indicated pressure. As a result, the studs were not properly elongated during the vessel assembly process.

Validation

BSEP uses the Stud Elongation Measurement System (SEMS III) to validate proper tensioning. Based on interviews conducted with the Maintenance mechanics, Quality Control (QC) inspector, and refuel floor supervisor, who were involved in obtaining and verifying the final elongation readings, it was determined that the individual recording the data on the refuel floor identified that the elongation values were low and did not match acceptance criteria (i.e., 0.045 inches ± 0.004 inches) specified in 0SMP-RPV502. At this point, the individuals involved in the task convened to discuss the readings. The crew erroneously concluded that the target elongation value of 0.045 inches was automatically deducted from the post-tensioned measured value indicated by the SEMS III equipment. The values obtained from the SEMS III equipment were compared to the specified tolerance in 0SMP-RPV502. Since the values obtained from the SEMS III equipment were between ± 0.004 inches, the crew determined that acceptable stud elongation had been achieved. The QC inspector concurred with the consensus opinion of the crew.

As a result of these errors, the RPV head studs were tensioned only approximately 10 percent of the required amount. During the ensuing power ascension, Unit 2 exited Mode 5 and ultimately reached Mode 2 with the vessel head not properly tensioned, resulting in an unanalyzed condition. The increase in unidentified drywell leakage, and subsequent reactor scram, was a direct result of this condition.

Event Cause

The root cause of this event is the failure to provide the proper training and procedure guidance to correctly interpret critical data used to validate that the RPV head nuts were properly tightened.

During reactor reassembly, operators applied less than adequate hydraulic pressure to the tensioner during the tensioning of the RPV head stud/nut assemblies. This occurred because the pressure readings were not

NARRATIVE

Event Cause (continued)

correctly determined due to an inadequate understanding of the digital readings displayed on the hydraulic pressure indicator. In addition, the subsequent stud elongation measurement readings taken were incorrectly concluded to meet the specified acceptance criteria for proper tensioning. This occurred because the individuals involved had an inadequate understanding of how the SEMS III equipment functioned. In both cases the crews involved relied on erroneous assumptions that led to incorrect conclusions.

Safety Assessment

The safety significance of this event is minimal. The maximum calculated leakage resulting from the event was 10.11 gpm. Operations personnel took appropriate action to shutdown the unit in a timely manner. All Emergency Safety Feature equipment was operable during this time.

To determine the increase in risk due to reactor head leakage, the risk was quantified over a 48 hour exposure period. This covers the time during initial pressurization to the final de-pressurized state. For the evaluation, small, medium and large break initiators were chosen to represent the leak. This Probabilistic Risk Assessment (PRA) evaluation demonstrated that the impact to the risk model is below 1E-06 for each break size and; therefore, this event had a minimal impact on risk.

Corrective Actions

The following actions have been completed.

- Unit 2 was manually scrammed on November 16, 2011.
- Procedure 0SMP-RPV502 was revised with respect to conducting stud elongation measurements.
- The refuel floor crews were trained on the proper operation of the SEMS III equipment and display of hydraulic pressure indicator for the tensioner.
- A structural integrity evaluation of the reactor pressure vessel components was performed prior to restart.
- Vessel hydrostatic testing was completed, prior to Unit 2 restart, verifying proper tensioning had been achieved.

The following corrective actions to prevent recurrence are planned.

- Revise procedure TRN-NGGC-0003, "Refueling Personnel Qualification Program," to include BSEP personnel. This action is expected to be completed by February 3, 2012.
- Revise lesson plan ME501B, "Mechanical Refuel Support," to include specific discussion on operation of SEMS III and proper hydraulic pressure readings during tensioning. This action is expected to be completed by February 2, 2012.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

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Corrective Actions (continued)

- Revise procedures 0SMP-RPV501, "Reactor Vessel Disassembly," and 0SMP-RPV502, "Reactor Vessel Resassembly," to include the need for initial refuel floor training (i.e., provided in ME501B) prior to work on refuel floor. This action is expected to be completed by February 28, 2012.
- Revise procedure 0SMP-RPV502 to include detailed guidance on use of the SEMS III equipment. This action is expected to be completed by February 28, 2012.
- Revise 0SMP-RPV501 and 0SMP-RPV502 procedure instructions for the layout and interpretation of the hydraulic tensioner pressure indicator. This action is expected to be completed by February 28, 2012.
- The BSEP Refueling Team training program and content, associated with RPV disassembly and reassembly, will be reconstituted using the systematic approach to training. This action is expected to be completed by March 1, 2012.

Previous Similar Events

A review of LERs and corrective action program condition reports for the past three years did not identify any similar previous occurrences.

Commitments

No regulatory commitments are contained in this report.